Clinical Topics

What happens to defaulters from a diabetic clinic?

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Abstract

The annual rate at which patients defaulted from follow up at the Wolverhampton diabetic clinic between 1971 and 1981 was 4.1% overall and 3.5% in white patients. In 1982 a study was started to discover what happened to white patients, born after 1919, who defaulted from the hospital clinic. There were 162 defaulters, of whom 19 had died. Of the remaining 143 patients, 19 were attending another hospital diabetic clinic, 22 had moved out of the area, and 28 refused to participate in the study. Seventy four agreed to participate: 39 were treated with diet, 15 with oral hypoglycaemic agents, and 20 with insulin. They were matched for sex, age, treatment, and duration of diabetes with patients attending the clinic.

Non-insulin dependent defaulters were significantly more overweight at diagnosis (40% v 25%; $p < 0.05$) and remained more obese. They developed significantly higher diastolic blood pressure (94 v 86 mm Hg; $p < 0.02$) and higher haemoglobin A_{1c} (HbA_{1c}) concentrations (11.7% v 8.4%; $p < 0.01$). They had significantly more neuropathy at reassessment (15 v 6 out of 54; $p < 0.05$) and a greater incidence of new retinopathy ($p < 0.02$), which correlated with their higher diastolic blood pressures ($p < 0.01$) and HbA_{1c} concentration ($p < 0.02$). In defaulters who were treated with insulin only the prevalence of neuropathy was significantly different from that in controls ($p < 0.05$).

Defaulters received minimal medical supervision and suffered greater morbidity than regular attenders at the clinic.

Introduction

Diabetic care in this district comprises a hospital run by consultants and 23 general practice diabetic clinics run independently (mini clinics). Patients who attended either clinic between 1971 and 1981 had a punchcard giving basic information and treatment, as previously described.¹ Information on attenders is continually updated.

In a survey of punchcards carried out in 1982 1117 people attended the hospital clinic and 1061 the mini clinic practices. The overall annual rate of defaulting from the hospital clinic was 4.1% with annual rates of 11% for patients receiving diet alone, 6% for those treated with oral hypoglycaemics, and 4% and 1% for those treated with insulin once or twice a day, respectively. Defaulting from mini clinics is much less of a problem and is not reviewed here.

Similar punchcard surveys were carried out in 1972, 1975, and 1978, and after each survey all defaulters were written to, and a proportion returned to the clinic, but this has been the extent of our system for recalling defaulters from the hospital clinic.

Scobie *et al* found an annual defaulting rate of 5% from their diabetic clinic, but after the number of deaths, moves away from the area, and patients who returned to the clinic had been eliminated the basic default rate was only 1.4%, and the authors considered that most of these patients were receiving medical supervision.²

Patients requiring insulin have a better prognosis if they maintain contact with a hospital clinic.³ We are unaware of any reports of the prognosis of non-insulin dependent defaulters from clinics, but a recent study suggested that even deliberate discharge of these patients from hospital clinics to the care of general practitioners may result in inadequate supervision.⁴

It was our clinical impression that defaulters from the hospital clinic were not consulting their general practitioners and tended not to thrive. We therefore studied patients who had defaulted from the hospital clinic between 1971 and 1981 to find out why patients defaulted, assess their medical supervision, and compare glycaemic control and the prevalence of diabetic complications with a matched group of patients who attended the hospital clinic regularly during the same period.

Patients and methods

A defaulter was defined as any patient who did not attend the hospital clinic in 1982 after a planned review had been arranged any time between 1971 and 1981. The study group was confined to white diabetics born after 1919 on the basis that these are the patients most likely to benefit from regular supervision. Asians were excluded because of language difficulties, and West Indians were excluded because of the effects of abnormal haemoglobins on haemoglobin A_{1c} (HbA_{1c}) assay.

There were 398 white defaulters between 1971 and 1981, of whom 162 were born after 1919 and were traced. Nineteen of these had died, thus a total of 143 patients were approached (study patients). Any defaulters born in 1919 or earlier were not traced.

Control patients were selected from the pool of patients who attended the clinic regularly in 1984 using basic punchcard data and without reference to clinical records. Each study patient was matched to the most similar control patient for sex, age, duration of diabetes, and category of treatment.

CLINICAL MEASUREMENTS

All members of the study group and control group were interviewed by a single observer (MSH). Tables were used to calculate percentage standard weight as an index of obesity.⁵ Blood pressure was measured with the patient sitting using Korotkoff phase V diastolic pressure. Direct ophthalmoscopy was performed through dilated pupils in a darkened room. Observations at diagnosis had been recorded by a single observer (PAT) and were repeated during the study by a different observer (MSH). Each eye was scored as follows: 0 = no abnormality; 1 = less than five microaneurysms and no other abnormality; 2 = background retinopathy; 3 = background maculopathy; 4 = new vessels or retinal gliosis lying flat over the peripheral retina; 5 = new vessels or retinal gliosis at the optic disc or growing forwards into the vitreous body; and 6 = advanced diabetic eye disease with secondary

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glaucoma or vitreous haemorrhage requiring vitrectomy.⁶ Retinas that could not be seen because of the opacity of lenses or corneal scarring were excluded, whereas those with scars of panperipheral ablative photocoagulation were given a score of 5. The eye with the highest score was used in the statistical analysis.

Achilles tendon reflexes were assessed with the patient kneeling on a chair and with reinforcement. In their absence evidence of peripheral sensory loss was sought and a score derived: 0=both ankle jerks present; 1=one ankle jerk absent; 2=both ankle jerks absent but no other evidence of peripheral neuropathy; and 3=peripheral neuropathy.

The presence of proteinuria was detected with Albustix and confirmed only after exclusion of urinary tract infection.

Examinations in the study were performed and recorded by a single observer (MSH) without access to previous observations. Data from the first visit to the diabetic clinic were compiled from the clinical records by the other observer (PAT) without knowledge of the study observations.

GLYCAEMIC CONTROL

Glycaemic control during the period of attendance was estimated from the mean of random measurements of venous blood glucose concentrations (glucose oxidase method) taken at the clinic. For defaulters the analyses encompassed the duration of their attendances at hospital; for attenders those obtained over the past five years were used.

Haemoglobin A₁ was measured with a kit from Corning Medical. The normal range (95% confidence limits) is 4.9%.

ANALYTICAL AND STATISTICAL METHODS

Results were compared using the sign test, Wilcoxon signed ranks test, and Smirnov test. The incidences of complications were compared using the χ^2 test. Student's *t* test was used to compare means, and a least squares linear regression and calculation of correlation coefficient were used to look for correlation between the two groups.

For the purposes of statistical analysis the patients receiving diet alone (39 patients) and those receiving oral hypoglycaemics (15) were grouped together and were considered to be non-insulin dependent (total 54). The remaining 20 patients were grouped together as insulin dependent.

Results

A total of 143 patients were traced: 19 were attending another hospital diabetic clinic in the area; 22 had moved away from Wolverhampton and were not pursued; 28 refused to participate in the study and declined further appointments to the clinic; and 74 formed the study group. Of these 74 patients, 39 were treated with diet, 15 with oral hypoglycaemic drugs, and 20 with insulin once or twice a day. Before default from the clinic the mean duration of attendance was three years for patients treated with diet alone, four years for those treated with oral hypoglycaemic agents, and 10 years for those treated with insulin. Twenty six (48%) out of 54 non-insulin dependent patients and four (20%) out of 20 patients treated with insulin defaulted within one year of diagnosis. The mean duration of default was 4.7 years (range one to 11 years) for non-insulin dependent diabetics and 4.5 years (range one to 12 years) for those treated with insulin.

Table I shows the characteristics of defaulters and controls divided into those treated with insulin and those not. No significant differences were found in sex, age, treatment, and duration of diabetes.

Patients were interviewed in the clinic with a structured questionnaire. Seventeen (31%) out of 54 non-insulin dependent defaulters thought that they were not ill enough to require attendance to hospital, four (7%) declared that they were "not diabetic." Fourteen (25%) claimed they could not afford

to wait in the clinic or lose time from work. Of those defaulters treated with insulin, seven (35%) out of 20 complained about the waiting time in the clinic and six (30%) did not think that the clinic helped them.

Three quarters of defaulters did not attend their general practitioners to discuss their diabetes. Only two (10%) out of 20 patients treated with insulin and two (14%) of 15 treated with tablets had regular consultations with their general practitioners about diabetes.

No patient could recall having had fundoscopy performed by their general practitioner, though some had attended the local eye hospital either because they had been referred before defaulting from the diabetic clinic or by indirect referral by their optician. Routine estimation of blood pressure and examination of feet were not performed. Regular urinalysis at home was performed by nine (45%) out of 20 patients treated with insulin, nine (60%) out of 15 treated with tablets, and 19 (49%) out of 39 treated with diet. No patient had been instructed in monitoring home blood glucose concentrations before default.

GLYCAEMIC CONTROL

During the period of attendance at the clinic there was no significant difference in mean blood glucose concentration of study or control patients, though patients treated with insulin had significantly higher mean blood glucose concentrations (table I). At the time of the study defaulters who were or were not treated with insulin had significantly higher HbA₁ concentrations than comparable control groups (11.8% v 10.4% ($p<0.05$) treated with insulin and 11.7% v 8.4% ($p<0.01$) not treated with insulin).

CLINICAL EXAMINATION OF NON-INSULIN DEPENDENT GROUPS

Weight—Defaulters were significantly more overweight at diagnosis than controls (means 40% and 25%; $p<0.05$) and remained significantly more obese at the time of the study (means 30% and 18%; $p<0.05$). Patients who were 65% overweight at presentation were as likely to default as to continue to attend.

Blood pressure—At diagnosis there were no significant differences in blood pressure: mean systolic blood pressure of defaulters was 149 mm Hg and controls 145 mm Hg, mean diastolic blood pressure of defaulters 88 mm Hg and controls 90 mm Hg. At reassessment defaulters and controls had similar systolic blood pressures (157 and 150 mm Hg, respectively), but the defaulters had a significantly higher mean diastolic pressure (94 v 86 mm Hg; $p<0.02$).

Neuropathy—No patient had clinical neuropathy at diagnosis. At reassessment 15 out of 54 defaulters and six out of 54 controls had significant neuropathy ($\chi^2=4.2$; $p<0.05$).

Retinopathy—Table II shows the distribution of retinopathy scores at diagnosis and reassessment in both groups. There was no significant

TABLE II—Retinopathy scores of non-insulin dependent patients. Values are numbers of patients

	Score of controls				Score of defaulters			
	0	1-2	3	4-6	0	1-2	3	4-6
At diagnosis	42	5	5		44	1	1	
At reassessment	27	16	8	2	23	18	12	1

difference in the distribution of retinopathy at diagnosis but later on the incidence of new retinopathy (where none had previously existed) was significantly greater in defaulters ($\chi^2=5.5$; $p<0.02$). At reassessment defaulters showed positive correlations between the degree of retinopathy and higher HbA₁ concentrations ($r=0.33$; $p<0.02$) and also between the development of new retinopathy and increasing diastolic blood pressure ($r=0.49$; $p<0.01$).

Nephropathy—No patient had proteinuria at diagnosis, but subsequently it was found in four out of 54 defaulters and one out of 54 control patients. These incidences are not significantly different ($\chi^2=0.8$; $p>0.1$).

CLINICAL EXAMINATION OF INSULIN DEPENDENT GROUPS

No significant differences with respect to weight, blood pressure, and retinopathy were found between defaulters and controls at diagnosis and reassessment. Neuropathy had, however, developed at reassessment in six out of 20 defaulters but in no control patients ($\chi^2=4.6$; $p<0.05$).

TABLE I—Data on patients

	Non-insulin dependent patients (M:F=35:19)		Insulin dependent patients (M:F=14:6)	
	Controls	Defaulters	Controls	Defaulters
Mean age (years)	56.7	55.7	47.7	47
Mean duration of diabetes (years)	8	10.3	15.8	16.7
Mean blood glucose (mmol/l)	7.2	8.0	9.7	9.5
Mean HbA ₁ (%)	8.5	11.7	10.4	11.8

Conversion: SI to traditional units—Blood glucose: 1 mmol/l $\approx$ 18 mg/100 ml.

Discussion

Half the white patients defaulting from the hospital diabetic clinic in this industrial town were treated with diet and most defaulted shortly after diagnosis. They attended their general practitioner more regularly than those patients treated with tablets or insulin and most felt well. Many were, however, badly informed of the long term risks of diabetes and had defaulted before the general introduction of comprehensive education programmes for new patients. The other half of the group, those receiving oral hypoglycaemic agents or insulin, saw less of their general practitioner and were poorly motivated to monitor or control their own disease despite the constant reminder of daily treatment to both doctor and patient. These patients were not as healthy as comparable patients attending the clinic; it may be that they defaulted because of certain traits in their personalities that also caused them to care less for their health. Alternatively, they may have simply drifted out of hospital follow up and subsequently been neglected.

A recent comparison of care at hospital and organised general practice run diabetic mini clinics in this same area showed that such a general practice based scheme can maintain as good glycaemic control as at a hospital.⁷ There is also a significantly lower rate of default from mini clinics than from hospital clinics.⁸ In contrast, patients in Wolverhampton who default from hospital to a general practice that is not organised to run a mini clinic fare worse—for example, non-insulin dependent defaulters had a higher incidence of peripheral neuropathy than even insulin dependent patients attending the clinic. The incidence of neuropathy in defaulters was not significantly correlated with duration of diabetes, suggesting that lack of supervision after defaulting is associated with the increased risk.

Attitudes to the disease as well as to the clinic may have led to some patients defaulting. This was sometimes expressed by defaulters as not realising the potential seriousness of the condition. Greater obesity seems to make it more likely that a patient will default. This may reflect the way in which failure of diet is dealt with in the clinic as much as feelings of frustration that may be harboured by the patient. The significantly greater obesity of the defaulters may contribute to their higher diastolic blood pressures, worse glycaemic control, and increased risk of developing new retinopathy.

The results of the distribution of retinopathy in non-insulin dependent defaulters and controls must be viewed with some caution. The groups were not matched for this variable at diagnosis, and more controls (10 out of 54) than defaulters (two out of 54) had retinopathy at diagnosis, though the difference was not significant. The consultant in charge informed patients of the presence of retinopathy at diagnosis, and it may have been this information that inclined patients to attend for follow up. Table II shows that retinopathy progressed in both defaulters and controls, but the incidence of new retinopathy was significantly greater in defaulters even though the differences between the groups remained insignificant. Eight out of 74 defaulters were sent for ophthalmic opinions for retinopathy that threatened sight at the time of reassessment and all agreed to be followed up. These patients represent a third of all those who have returned to regular attendance at the clinic since the study period. The fear of blindness undoubtedly motivated these patients.

In this study differences in biochemical control and morbidity from complications were seen most clearly in non-insulin dependent patients who defaulted compared with those who attended the clinic two to four times each year. This suggests that discharge of non-insulin dependent diabetic patients to general practices that are not prepared to undertake structured diabetic care is inadvisable, a view borne out in other studies.⁴

Four clinical audits of the Wolverhampton diabetes care scheme have been performed since 1970, and on each occasion all defaulters were sent personal letters inviting them to contact the clinic for further follow up. It was not routine practice to inform general practitioners when their patients defaulted, and this study has made us aware of a need to provide a better system to encourage such patients to continue regular review. The education programme is expanding, and we hope that better educated patients will be less likely to default. Increasingly, diabetes health visitors are attempt-

ing to visit defaulters, and more letters of recall are being written. It is doubtful if these offers will be taken up by people who think that they are not ill enough to require attendance to hospital (21 out of 74 in this study) or who are unable to spare the time (14 out of 74 in this study). Improved management of clinics may reduce waiting time and increase the continuity of care, perhaps encouraging some to more regular attendance. Computerisation of the clinical audit will make the process of identifying defaulters easier.

The results of this study show a need for investment of time and money to reduce the rate of default. Control of weight, blood pressure, and blood glucose concentrations in attenders is associated with reduced morbidity. Systematic supervision of diabetic patients by their general practitioners obviously reduces the risks if the patient defaults from the hospital clinic, and we believe this to be an important benefit of community care schemes such as mini clinics. Computerising our own diagnostic registers will allow us to provide general practitioners with better information about diabetic patients in their own practice.

Many strategies, administrative, educational, and clinical, can be adopted to recover patients who miss their appointments at the clinic. A hard pressed service is perhaps disinclined to make this effort, which in itself generates more work. The cost of neglecting these patients is, as shown in this study, to increase their morbidity. Experience shows that these patients will return to the clinic at a time when it will be too late for preventive treatment and when the cost of palliative care has become even greater.

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Could there be any clinical consequences if infant feeds are made up using boiled and then cooled water from a kettle in which the heating element has some evidence of corrosion and rust (as is common after a few months in many kettles)?

The main constituents of rust are ferric hydroxide and hydrated ferric oxides. The latter are insoluble and the total soluble ferric ion in equilibrium with ferric hydroxide at pH 8 calculated from the solubility constant is only 0.2 µg/l.¹ The solubility of ferric salts will be modified by the concentration of salts in the water and increased by a fall in the pH. A concentration of 0.2 µg/l, however, represents only 0.2% of the WHO recommended limit for the concentration of iron salts in drinking water and is considerably below the average concentration found in tap water. This is why iron pipes are widely and successfully used to distribute domestic water supplies. The iron content of human milk is 0.5 mg/l and of reconstituted milks up to 12.1 mg/l.² The bioavailability of iron in domestic water supplies is not known but is probably less than that of reconstituted milk and will probably provide no more than 10% of the daily nutritional requirement of iron.³ So it is highly unlikely that toxic amounts of iron can be ingested from water boiled in a rusty kettle.—T GRAY, senior registrar, Birmingham.

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